

INSTRUCTIONS FOR THE COLLECTION AND PRESERVATION OF BOTANICAL SPECIMENS¹

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In gathering plants you will do well to pay attention to all the plants you come across, whether showy or unsightly. Do not neglect the latter on account of their appearance.

Collect if possible several specimens of the same plant, partly to show different states of the same species, and partly to be able to distribute them among different botanists.

Do not be deterred from gathering what appears to be the same species at different places and seasons. It may prove not to be the very same species, but only an allied species; or even if identical it is interesting for the study of geographical botany to have the same species from distant localities.

On the whole collect only such plants as you find in flower or fruit; but trees and shrubs ought to form an exception, as also smaller plants, if they afford some particular interest, either by their medicinal or other properties, great preponderance in certain districts, etc.

The most important part of the plant is the *flower* and *fruit*. Get if possible such specimens as present both states, flower and fruit, or both on different specimens. You will find plants which have fertile and sterile flowers distinct, they occur either on the same plant, as in the oaks, hickories, etc., or in different plants, as in the willows, cottonwoods and others. In both cases it is important to collect specimens which show each of them.

Many plants develop the leaves after the flowers, as the oaks, redbuds and many others. In these the flowers must be preserved, and later in the season, the leaves with the fruits; but great

care must be taken to get them from the same species.

If the specimen you obtain is not too large, gather it entire, with the root or at least with part of it, so as to show the nature of that organ. Try to have the lower as well as upper leaves complete on the specimen, especially if they should differ from each other.

In case the specimen is too large for a sheet of paper, say more than 17 inches high, it may still be preserved entire, by bending or rather breaking (without entirely severing the parts) the stem in an acute angle. If necessary, this may be repeated and branches or leaves may also be treated in the same manner. This is better than cutting it in different segments, as these might become separated and much confusion ensue from this cause.

Of still larger plants, shrubs, trees, it is possible to take only a part, a branch, etc.; but if there should be different leaves on the plant, it will be necessary to cut off such leaves with a small piece of stem attached, and preserve them with the other specimens.

Make the specimen large enough to present a fair sample of the plant, its manner of growth, ramification etc.

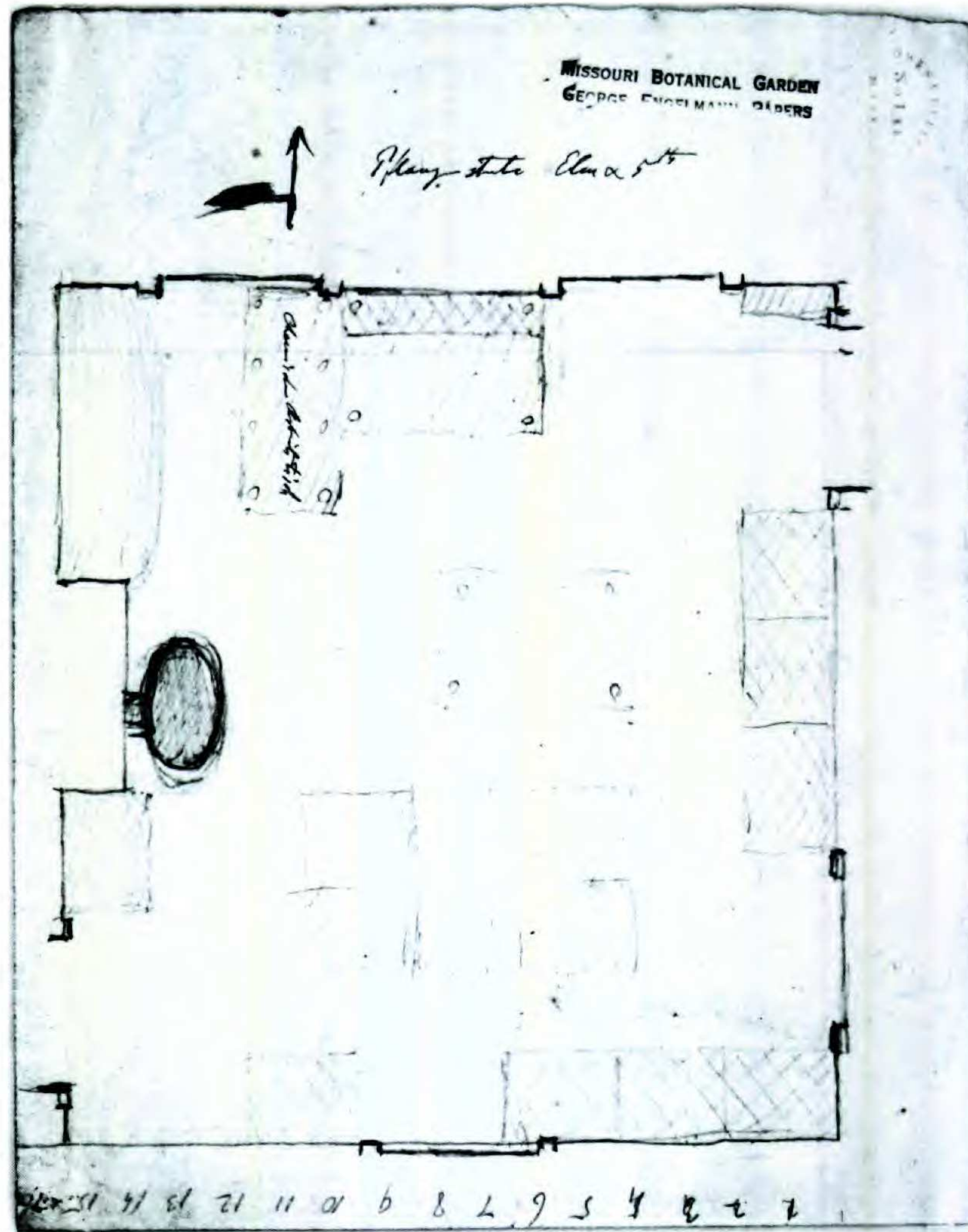
It will be well to put your specimens in paper as soon as gathered; their parts are then fresh and still and are easily spread out in a neat way; but if they become flaccid they present much difficulty, and the dried specimens will appear unsightly.

Large specimens with thick stems or roots (bulbs especially) or even very clumsy flowers (as

¹ These instructions exist as a manuscript in the George Engelmann Papers at the Library, Missouri Botanical Garden. They are printed here verbatim and unedited for spelling and punctuation. The manuscript is in a scrivener's hand, but there are a few corrections and additions by Engelmann, and he inserted an illustration of how to bend a specimen that is "too large for a sheet of paper."

Engelmann must have communicated these or similar instructions to those who collected for him. For example, Josiah Gregg wrote to Engelmann: "I could get no stiff pasteboard for portfolios" (10 February 1847); "I repeat that your instructions in every regard, have been of infinite use to me" (13 August 1847); "I have followed the system of numbering as you directed" (14 April 1849). (See, *Diary & Letters of Josiah Gregg*, M. G. Fulton, editor, 2 volumes, 1941, 1944, University of Oklahoma Press, Norman.) The Instructions provide a glimpse of plant collecting techniques in the middle of the last century and contain valuable pointers that the modern collector could take to heart. The legends to the illustrations were written on Dr. Engelmann's behalf by M. R. Crosby, who remains close to him through his correspondence and other papers.

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An early St. Louis herbarium. After receiving my medical degree from Würzburg and spending a year studying in Paris, I came to the United States in 1832 on behalf of my family to investigate the possibilities of further investments in and emigration to Illinois and other western lands. I was naturalized in Philadelphia on December 24, 1832 and immediately proceeded to the Shiloh Valley of St. Clair County, Illinois. The next two years were unsatisfactory, though I made an interesting trip to the Arkansas Territory, losing my money, gun, and health along the way. Returning to Illinois, I decided to recross the River to St. Louis. Settling there in November 1835, I established my practice at 3rd and Chestnut Streets, planning only to remain long enough in this frontier town of 8,300 Anglo-Americans to save enough money to return to my native Germany. But, my practice flourished and the plants of the West were much more interesting than those of Europe. In 1847, against the advice of my friends, I moved to the far western part of town, to the southwest corner of 5th and Elm Streets, where Busch Memorial Stadium now stands. Here my medical practice continued to expand, and here I carried out many of my botanical investigations.

The sketch reproduced here is among my Papers, now preserved in the Library of the Missouri Botanical Garden, and shows my herbarium, which adjoined the medical office. As later workers have found, I used and reused paper (see *Ann. Missouri Bot. Gard.* 61: 907. 1974), and this sketch is on the back of later detailed drawings of *Isoëtes*. It is labelled "Pflanzstube Elm & 5th" at the top; the arrow points north. The up-side-down scale along the bottom is in English feet. The outline of the room indicates two windows on the north side and one each on the east and south sides of the room. Doors are located diagonally across from each other in the northeast and southwest corners. The dark oblong near the west wall is the free-standing, coal-burning stove, connected to a chimney by a short, dark pipe. There were two work tables, indicated with diagonal marks and circles in each corner as legs, one on the north wall, shelf above, and one near the center of the room. A third table, "Chemisch Arbeits Tisch," was placed perpendicular to the north wall, next to the work table with the shelf. The eight nearly square, cross-hatched structures along the east, south, and west walls are herbarium cases, as is the block of six, free standing, diagonally marked structures between the center table and the south wall. These cases' capacity was more or less equivalent to the steel ones in common use in the late twentieth century, so the room held about 14,000 specimens, when filled to capacity, a common problem even 150 years ago! There was a book shelf in the northeast corner, next to the door.

In 1869 I moved farther west yet, to Locust and Garrison Streets, and of course the herbarium went with me. I willed my herbarium to my only child, George Julius Engelmann, also a physician, but not a botanist. At that time the collection numbered about 98,000 specimens, including many nonvascular cryptogams. George J. donated the Herbarium to the Missouri Botanical Garden before 1890.

large thistle heads) often require to be split lengthways, so as to make them less bulky and injurious to the other plants in the herbarium.

Large fruits may be also split, or they may be preserved separately, wrapt in paper.

In putting up the specimens, spread them out in such a manner that all the different parts are seen, and the flowers, or some of the flowers, are laid open. If, however, time should be wanting, the plant may be laid in the paper just as it is.

The object of pressing plants, being to keep all the parts spread out smooth, and free from shrinking and wrinkling, but not to crush the more delicate organs, the flowers especially: the pressure should be moderate, say from 25 to 40 or at most 50 pounds in weight, so as to compress not destroy the organs, that they may afterward be examined. In traveling, two boards tightly strapped together will be quite sufficient to press plants. At home any weight of 30 or 40 pounds will do the same service.

After the specimen has been put in paper and pressed a while, it becomes necessary to change the layers of paper as soon as they have become damp from the moisture absorbed from the plant and to substitute dry ones for them. This ought to be repeated daily till the specimen is completely dried.

The most convenient method is to put the specimen in finer paper, say printing paper, then a layer of 2, 4 or 6 sheets of coarser bibulous paper, then a finer sheet with a plant and so forth. In changing the plants dry layers are substituted for the moist ones without removing the specimen from the finer sheet immediately touching it, which would be a tedious job, often injuring the specimen. The damp layers are then hung up or spread out and dried. The dried specimens are put aside between single leaves or sheets of paper, as many in one sheet as may be put there without injuring each other. When you have got a sufficiently sized bundle together, pack it either in a box of convenient size or in a fresh skin of some animal (hair inside) which will harden and shrink and form an easily handled and safe package.

A specimen is of much less value if not properly labeled. Therefore as soon as collected or when put up, attach a piece of paper to it, (the most simple method is to stick the stem through a hole in the paper,) on which you note at least *date* and *locality*; but if possible also every thing you can ascertain about the plant and which does not appear in the dried specimen itself: colour of flower, taste, smell, time of opening and clos-

ing of flowers, size of the plant, height, diameter of stem (in trees); nature of the soil (swamp, sand, rocks, open places, shade, etc.), whether frequent or rare. In parasitic plants it should be stated on which plant they grow. Besides this it will be well to number your plants as you collect them. This number will stand for a name and can always be referred to, especially if you keep a journal or some other memoranda of your collections, or in correspondence with other botanists, to whom specimens may be communicated.

You will further materially advance our knowledge of the vegetable kingdom, if you could collect any parts of plants or products of plants, which may be valuable or curious, such as medicinal roots, barks, gums, etc.

Make it an especial object to collect the fruits of plants which cannot be preserved in the herbarium, such as pine cones, nuts and others. Get also specimens of the woods. Of stems not thicker than 3 inches in diameter, take a whole piece 12 inches long, of larger ones only a section of the stem, showing bark, alburnum (exterior soft wood) and hard interior wood.

All such specimens of fruits, woods, roots, may very conveniently be labeled and marked with the same numbers as the specimens of the plant from which they are derived.

Collect also ripe seeds as many as you can get. Preserve them in their pods or fruits as they keep longer fresh in them. In wrapping them up, put if possible, a few leaves, a small branch, flowers or whatever part you can get, with them, and number them with the same number as the dried specimen of the same plant.

Seeds ought to be sent as soon as possible, as many lose their power to germinate if too old. They ought to be packed dry but not too tight as they may suffocate and moulder.

I have more especially studied several families to which I wish to direct your particular attention. I mention the *Asclepiadeae* and *Euphorbiaceae*, both comprising plants with milky juice, the first mostly with showy, umbellated flowers and silky appendage to the numerous seeds, the other with very inconspicuous greenish flowers and seeds. Further the *Pines*—then all the *parasites* such as the *Cuscutas* (Dodder or Lovevine) and the species of *Viscum* which grow on trees (Mistletoe) some of them of great interest on *Pines* in the Pacific region.

Above all others I mention the *Cactus* tribe, which I have not only studied (Fig. 1), but also cultivated. Specimens of Cacti in flower and in

fruit are important as well as entire plants, especially living ones for cultivation. For the herbarium the flower must be preserved with a piece of the plant attached to it, which shows the ridges or tubercles and spines. In your labels do not forget to describe the shape of the entire plant, number of ribs, number, shape, direction and color of spines in each bunch.

The Cacti are easily propagated by seed, but also living plants may be kept very long (from 6 to 12 months); they must be kept dry and not packed too close, nor before they have been kept for some time withering, or they will rot. Young plants are preserved better than old ones in this manner.

The most convenient apparatus for drying plants I have found in traveling is the following. Stitch or paste 2 or 3 sheets of coarse soft brown paper together at their backs, and string about 20 or 25 of such layers on one string, each fastened about one inch from the next. Put them in a strong pasteboard portfolio, and put several of these portfolios in a press of two pieces of plank, strapped together tightly. The strings of layers, when damp, are hung up in the open air and quickly dried, and put together again without loss of time. Finis.

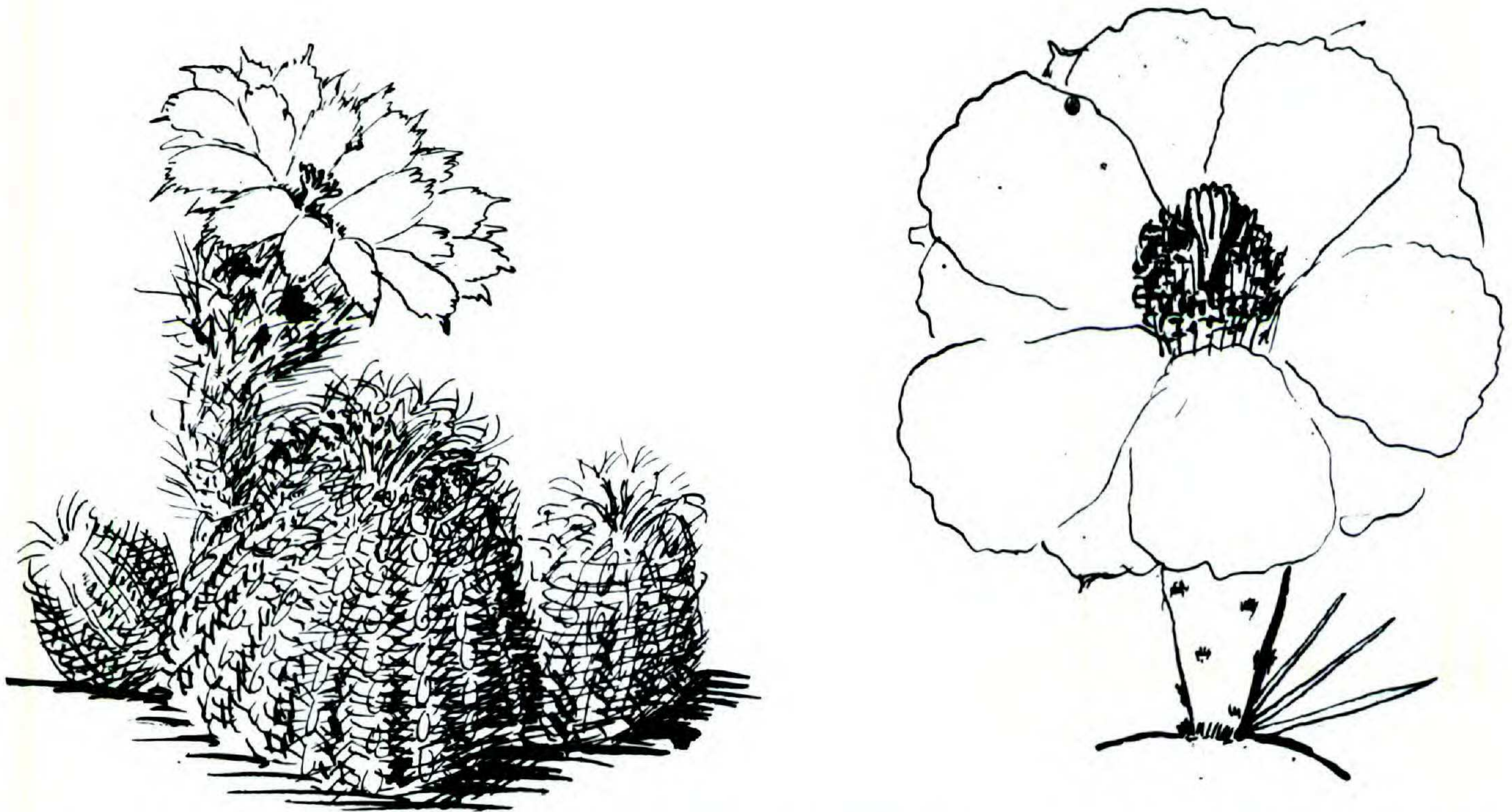


FIGURE 1. My botanical works were often beautifully illustrated, especially by Paulus Roetter, rather than by my own drawings. But, I made thousands of sketches of the plants I studied, and these are now in my Papers at the Missouri Botanical Garden. The western collectors who sent me material were especially good about supplying material of my groups. The two cacti reproduced here accompany four pages of notes I made from living material in 1845. These notes relate to my paper published with Dr. Gray, "Plantae Lindheimerianae, an enumeration of the plants collected in Texas, and distributed to subscribers," Boston J. Nat. Hist. 5: 210-264. 1845. I labelled the figure at the left *Cereus caespitosus*, now known as *Echinocereus reichenbachii* according to Benson's recent monograph. That at the right I called *Opuntia vulgaris*—a difficult complex: it may represent any one of a number of species of *Opuntia*.